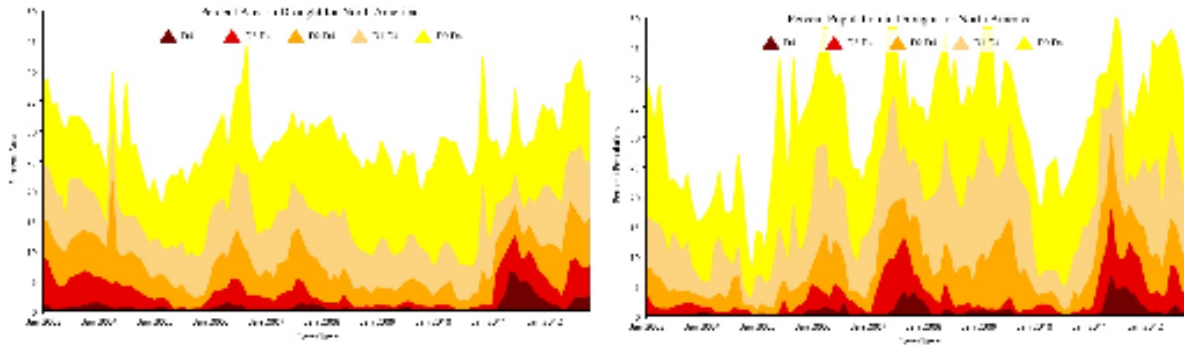


North American Drought Monitor - November 2012

At the end of November 2012, moderate to exceptional drought (D1-D4) affected approximately 24.9% of the area and 26.7% of the population of North America. These percentages are about the same for area and an increase of about 9.0% for population compared to the end of October.



CANADA: Above normal precipitation throughout November resulted in a slight decrease in extent of drought in Western Canada, while drought classifications in Eastern Canada were largely maintained due to below normal monthly precipitation and continuation of impacts from the summer drought. There were very few regions of the country with any significant concerns for drought as much of Canada has entered the cold season. The lack of drought concerns will likely remain over the next number of months. The one region of the country that continues to receive some attention is the southern and eastern regions of Ontario due to the significant drought during the spring and summer of 2012, and recent lack of precipitation. These concerns were put on hold as the region received adequate autumn precipitation. Temperatures for November were generally normal to slightly above from northwest Ontario eastward and in southeast British Columbia, while the west was generally cooler at up to 4°C below average.

Moderate Drought (D1) classifications were maintained in southwestern Ontario and southern Quebec. Much of southern Ontario continued to recover from the summer drought conditions and low water condition warnings remained. Lake levels in the Great Lakes ranged from below normal to near record lows. Abnormally warm temperatures throughout the region, combined with below normal precipitation resulted in the continuation of the D0 and D1 ratings. Portions of southern Quebec were classified D1; snowfall in the region was limited in November, and over the past three months precipitation was down about 80 mm (over 3 in). The severe drought over the growing season continues to impact the region, most notably feed supplies and pasture conditions. The 'Hay East 2012' initiative is one example of response to the drought in the Ontario and Quebec region, bringing hay from areas of oversupply in Western Canada to Ontario and Quebec.

Dry conditions remained in the northern Peace River region of Alberta, however above average snowfall in November should help to improve drought conditions in the region; but longer term impacts will remain. Over six months the region is short approximately 50 mm

(2 in). Livestock feed shortages were reported in the region, and anticipated feed production for next season was well below average.

Much of southeastern Saskatchewan and southwestern Manitoba received more than 150 percent of normal precipitation in November; some areas even reported record snowfall for the month. This will help alleviate dry conditions remaining in both provinces. In contrast, very little precipitation fell in November over the drought affected regions of southeastern Manitoba and northwestern Ontario where moderate drought (D1) conditions persisted. Feed supplies were also expected to be short over the winter.

In the Atlantic region, precipitation levels were normal over the past three months, however snowfall was largely absent throughout November; as a result the region will be monitored closely over the course of December.

Acknowledgements: We acknowledge and thank the following organizations whose reports and assessments were consulted to produce the Canadian portion of the North American Drought Monitor:

- AAFC District and Regional Offices
- Alberta Environment
- Alberta Agriculture and Rural Development
- B.C. Ministry of Environment – River Forecast Centre
- B.C. Ministry of Forests & Range, Wildfire Management Branch
- B.C. Ministry of Agriculture and Lands
- Environment Canada
- Manitoba Agriculture, Food and Rural Initiatives – Ag-Weather Program
- Manitoba Water Stewardship
- Natural Resources Canada – Canadian Forest Service
- Ontario Ministry of Natural Resources – Surface Water Monitoring Centre
- Ontario Ministry of Natural Resources – Aviation, Forest Fire and Emergency Services
- Saskatchewan Ministry of Agriculture
- Saskatchewan Watershed Authority
- Saskatchewan Environment Fire Management and Forest Protection Branch

UNITED STATES: November 2012 marked a return to the warmth and dryness which characterized much of the year. Like the last several months, cool fronts swept across the country, bringing below-normal monthly temperatures to most areas east of the Mississippi River. High pressure, centered over the Southwest and Central Rockies, dominated the West and Great Plains with its descending air ("subsidence"), resulting in a monthly pattern of anomalous warmth there. The associated circulation pattern dumped above-normal precipitation across parts of the West from California to the Northern Rockies and northern High Plains, but it reduced precipitation across the rest of the country, inhibited the formation of tornadoes, and reduced the coverage of snow. The wet weather in the West nibbled away at the edge of the drought areas in the Pacific Northwest and northern High Plains, but dry weather expanded drought in the Southeast, Southern Plains, and Hawaii.

Nationally, the moderate to exceptional (D1-D4) drought footprint increased to about 52.4% of the country, compared to last month, while the percentage in the abnormally dry to exceptional drought category increased to about 71.2%. About 16.8% of the country was in the worst drought categories (D3-D4, extreme to exceptional drought), a bit more than last month. The Palmer Drought Index, whose data go back 113 years, is relied upon for drought comparisons before 2000. The November 2012 Palmer value of 59.5% in moderate

to extreme drought is an increase of about 7% compared to last month, and the percent area in severe to extreme drought increased to about 44.8%.

By the end of the month, the core drought areas in the U.S. included:

- a large area of moderate (D1) to exceptional (D4) drought stretching from the western High Plains, across the Northern and Southern Great Plains, into the Upper Midwest and Mid-Mississippi Valley;
- a persistent area of moderate to exceptional drought in the Southeast to Mid-Atlantic;
- an area of moderate to extreme (D3) drought across much of the West; and
- much of Hawaii, where moderate to extreme drought persisted.

The spatial and temporal pattern of moisture supply can be analyzed using the Standardized Precipitation Index (SPI). The 1-month SPI map shows the area of November dryness covering most of the country east of the Mississippi River, the Southern and Central Plains, and the Central Rockies to Southwest. Near normal to wet conditions stretched from northern California, across the Northwest, to the Northern High Plains. Much of the Northwest (especially coastal sections) shows up as wet at all-time scales. The Northeast is dry at the 1-month time scale but near normal to wet at the 2- to 24-month time scales. Dryness dominates in the Southeast at all-time scales, except wet conditions are evident at 6 to 12 months along the Gulf Coast. The Ohio Valley has evidence of wet conditions at 3 and 24 months, but dry conditions at 2, 6, 9, and 12 months. Dry conditions dominate at all-time scales across the Southwest to Southern and Central Plains, spreading into the Northern Plains and Midwest on the 6- to 12-month SPI maps.

The Palmer drought indices measure the balance between moisture demand (evapotranspiration driven by temperature) and moisture supply (precipitation). The Palmer Z Index depicts moisture conditions for the current month, while the Palmer Hydrological Drought Index (PHDI) depicts the current month's cumulative moisture conditions integrated over the last several months. Used together, the Palmer Z Index and PHDI maps show that the November short-term drought conditions exacerbated long-term drought conditions across the nation's drought areas, resulting in an increase in the percent area under drought. The November short-term dryness essentially neutralized the areas of October moistness that had developed in the Northeast to Ohio Valley. The areas that received above-normal precipitation were mostly in the Northwest, which was for the most part drought-free.

Dry conditions persisted in Hawaii. Following its driest October in a record beginning in 1950, Lihue, Kauai received only 14.7 mm (0.58 in) this month and tied 1968 for the driest November on record. Stations throughout the state recorded below normal precipitation, with percentages of normal as low as 9 percent in Honolulu. Record low November precipitation totals occurred at several locations in the state. At the end of November, 54% of the state was experiencing some level of drought and the rest of the state was classified as abnormally dry.

Historical Perspective: According to preliminary information provided by the NOAA National Climatic Data Center, November 2012 ranked as the 20th warmest and eighth

driest November (based on data back to 1895) when weather conditions are averaged across the country. On a statewide basis, November 2012 ranked in the driest third of the historical record for November for 22 states – mostly east of the Mississippi – with five states (Connecticut, Florida, New Hampshire, Vermont, West Virginia) second driest in the 1895-2012 record. Three states (Nebraska, South Dakota, and Minnesota) fell in the top ten driest category for September-November 2012, while another 14 ranked in the driest third of the historical record for the season. At the six-month time scale the Central Rockies to Central Plains were the epicenter of dryness, with Nebraska and Wyoming having the driest June-November in the 1895-2012 record. Eight other states (from the Southwest to the Upper Midwest) were in the top ten driest category and an additional twelve states (from the West to Midwest and in the Southeast) ranked in the driest third of the historical record for June-November. Colorado had its driest January-November during 2012, and Nebraska and Wyoming had both their driest January-November and December-November in the 1895-2012 record. Eight other states ranked in the top ten driest category for the year-to-date (January-November) and another 19 were in the driest third of the historical record. A total of eight states were in the top ten driest category for the last twelve months (December-November) and another 21 were in the driest third of the historical record.

Five states in the West had the tenth warmest, or warmer, November in the 1895-2012 record with another 13 from the West and Plains ranking in the warmest third of the historical record. One state (North Carolina) had the tenth coldest November with 17 additional states east of the Mississippi River ranking in the coolest third of the historical record. On a local basis, almost three times as many record warm highs and lows occurred than record cold highs and lows. About 1800 daily high temperature records and 1300 record warm daily low temperatures were tied or broken. In comparison, about 450 record low temperatures and 600 record cool daily high temperatures were tied or broken. (These numbers are preliminary and are expected to increase as more data arrive.) Unusual warmth dominated at longer time scales, with 18 states having the warmest year-to-date on record and all 48 contiguous states ranking in the warmest third of the historical record for January-November. The preponderance of unusual warmth and dryness for much of 2012 has ranked the national U.S. Climate Extremes Index as the largest for the year-to-date.

Agricultural and Hydrological Highlights: Dry weather from South Dakota to Texas left U.S. winter wheat conditions at their lowest levels for late November since records of that type were initiated in 1986. November 2012 ranked as the 13th driest November in the 1895-2012 record averaged across the Winter Wheat agricultural belt, with April-November third driest and the year-to-date eighth driest. For the smaller Primary Hard Red Winter Wheat belt, November 2012 ranked 23rd driest, October-November tenth driest, April-November second driest, and the year-to-date third driest (behind January-November 1956 and January-November 1910). By November 25, more than one-quarter (26%) of the wheat was rated very poor to poor, fueled by abysmal crop ratings in South Dakota (64% very poor to poor), Nebraska (46%), Oklahoma (44%), Texas (40%), Colorado (34%), and Kansas (25%). Despite the beneficial precipitation that fell across northern California and from the Pacific Northwest to Montana and North Dakota, winter wheat still struggled to emerge on the northern Plains due to the normal seasonal decline in soil and air temperatures. By November 25, a significant portion of the wheat had not yet emerged in

South Dakota (only 60% emerged) and Montana (68%). In the Southeast, mostly dry conditions promoted fieldwork – including winter wheat planting and cotton and soybean harvesting – but caused renewed drought intensification in Alabama and the southern Atlantic States.

Toward month's end, precipitation intensity increased across northern California and the Northwest. However, mild weather accompanied the storminess, limiting high-elevation snowfall. As a result, the water year-to-date (October-November) precipitation pattern for the West was generally above-normal in the north and below-normal in the south, while the water content of the mountain snowpack was generally below normal across the West. The end-of-month water content of the Sierra Nevada snow pack stood at just 4 inches, according to the California Department of Water Resources, 85% of normal for November 30. On a statewide average basis, the reservoirs in most western states averaged below normal, except reservoirs averaged near to slightly above normal in Montana and Washington. The dry November experienced by most areas from the Great Plains to the East Coast further lowered streamflow levels in the Missouri and Mississippi river basins, with January-November ranking as the third driest such 11-month period in the 1895-2012 record for the Missouri basin and the Mississippi and its tributaries north of Memphis, Tennessee. The driest January-November periods for both basins occurred in 1936 and 1934. As noted by the NOAA Midwest Regional Climate Center, drought has contributed to low water issues from the Great Lakes to the Missouri and Mississippi rivers, with navigation on the Mississippi River becoming a growing concern as levels continued to drop through November. In the northern Mid-Atlantic region, dry weather aided recovery efforts from Hurricane Sandy.

MEXICO: In November, six days of severe storms which brought more than 70 mm (2.7 in) per day were recorded throughout the month. These storms ranged from Coahuila to the northeast and from coastal Tamaulipas to south Veracruz State. The highest intensity of rain was received on November 23, with a national average of 3.3 mm (0.13 in) per day. This was due to the passage of a frontal system located between Coahuila and Nuevo Leon; the highest rainfall reported was 86.3 mm (3.4 in) in Cabezones, Nuevo León. The rest of the rains thorough the month were distributed from the coast of Colima and Michoacan to northern Veracruz, as a result of Pacific moisture fluctuations driven by the subtropical jet stream during the first half of the month. Chihuahua, Coahuila and northern Durango regions also had above average rainfall, mostly because of frontal systems.

Nationwide, November total rainfall averaged 22.4 mm (0.88 inches); 28 percent below the historical average since 1941. Statewide, Nuevo Leon had the second wettest November on record, while Chihuahua, Michoacán and Querétaro were in the top ten. Thanks to the rainfall over the last six months, many states' drought ratings improved. Baja California Sur had the third wettest June to November period on record, so the previous abnormally dry (D0) classification was eliminated. Chihuahua had the 18th wettest period from June to November, which eliminated the abnormally dry (D0) areas, and reduced some portions of moderate drought (D1).

Monthly mean temperature was 19.4 °C (58.1 °F) for the country, and 0.5 °C (32.9 °F) above the 1971-2000 normal; that made it the eighth warmest November since 1971.

Temperature classifications ranged from the second warmest November in Chihuahua and Nayarit to much cooler in Yucatan which averaged 15.9 °C (60.6 °F), and 2.5 °C (36.5 °F) below normal. The south and southeast regions recorded mild monthly temperatures overall. Elsewhere, Campeche had the third coldest, while Veracruz, Tabasco and Quintana Roo had the fifth coldest November on record. Guerrero and Jalisco, on the Mexican Pacific, had very close to normal temperatures.

A slight increase in drought classifications, from severe (D2) to extreme (D3) and the emergence of new areas of abnormally dry (D0) in the southern and southeastern regions occurred. The rainfall in northern Tamaulipas was not enough to offset the drought over the last few months; the drought continued to develop southward and raised concern about imminent extreme drought (D3). In contrast to the improvement seen in northern regions of the country, new abnormally dry areas emerged in central Mexico and the south this month. The most significant drought areas were located on the south coast (to the limits of Guerrero and Oaxaca), in the north of Campeche and the northeastern tip of the Yucatan Peninsula. There is concern about the development of drought over these regions because the seasonal outlook indicates below normal rainfall, coupled with the uncertainty about the development of El Niño in winter 2013.

The Information System Agrifood and Fisheries (SIAP) reported that as of December 10th 50 percent of the intended corn crop was sown, estimated at 961 000 hectares (2.3 million acres). The bean crop was at 72 percent planted (244,000 hectares, 602,937 acres). Wheat grain was at only eight percent, mainly in Sonora and Baja California (605,000 hectares, 1.5 million acres). Because of last year's drought, frost and some damage from pests, perennial crops suffered production volume deficit; this was mainly for orange, apple, grapefruit, lemon, mango and peach.

Regarding livestock, a decrease in milk production was observed in November due to reduced rainfall; however this behavior is consistent with the seasonality of milk production. As a result of the dry season in 2011, bovine meat production was at a minimum growth level because of the reduced availability of cattle for fattening, and the high price in pastures which resulted in higher calf exports last year. The pork industry also saw limited growth as did poultry, as a result of high production costs. The repopulation of laying hens in Jalisco is progressing well, but is not yet at its optimum level. Typically winter weather is adverse for egg production, so production is expected to continue below the levels reached before the avian influenza.